Single Spin Asymmetries on a transversely polarised proton target at COMPASS

S. Levorato on behalf of COMPASS collaboration

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1. Single Spin asymmetries

The cross-section for polarised deep inelastic scattering[1] of leptons off spin 1/2 hadrons can be expressed, at leading twist, as a function of three independent quark distribution functions: $q(x)$, $\Delta q(x)$ and $\Delta_T q(x)$. The latter, which describes the probability of finding a quark with spin parallel to the nucleon spin in a transversely polarised nucleon, is chiral-odd and can be measured in transversely polarised nucleon (anti)-nucleon hard scattering or in semi-inclusive deep inelastic scattering (SIDIS) on a transversely polarised target.

In SIDIS $\Delta_T q(x)$ can be measured in combination with the chiral odd Collins fragmentation function $\Delta_0^T D_q^h$, via azimuthal single spin asymmetries (SSA) in single hadron production. According to Collins,[2] the fragmentation of a transversely polarised quark in unpolarised hadrons presents

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$$N = N_0 \cdot (1 + f \cdot P_t \cdot D_{nn} \cdot A_C \cdot \sin(\Phi_C)) \tag{1}$$

where f is the target dilution factor, P_t the target polarisation and $D_{nn} = (1-y)/(1-y+y^2/2)$ the transverse spin transfer coefficient from the initial to the struck quark. The angle Φ_C is known as "Collins angle" and is conveniently defined in the system where the z-axis is the virtual photon direction and the x-z plane is the muon scattering plane. In this frame $\Phi_C = \Phi_h + \Phi_S - \pi$, where Φ_h is the hadron azimuthal angle, and ϕ_S the azimuthal angle of the transverse spin of the initial nucleon. Finally A_C is the Collins asymmetry resulting from the convolution between the Collins fragmentation function and the transverse spin distribution:

$$A_C = \frac{\sum_q e_q^2 \, \Delta_T q(x) \, \Delta_T^0 D_q^h(z, p_T^h)}{\sum_q e_q^2 \, q(x) \, D_q^h(z, p_T^h)} \tag{2}$$

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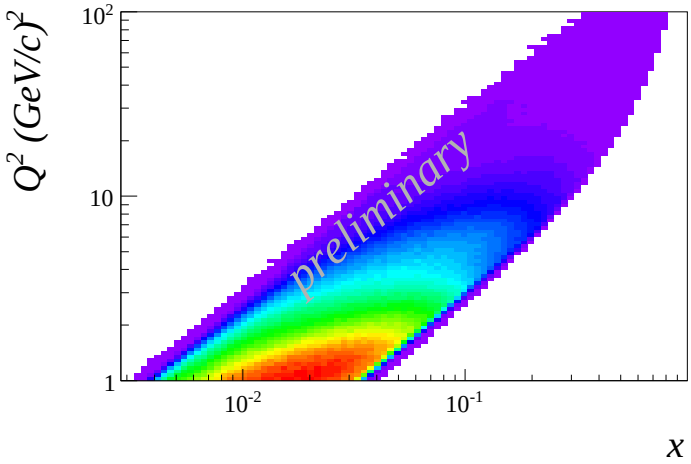

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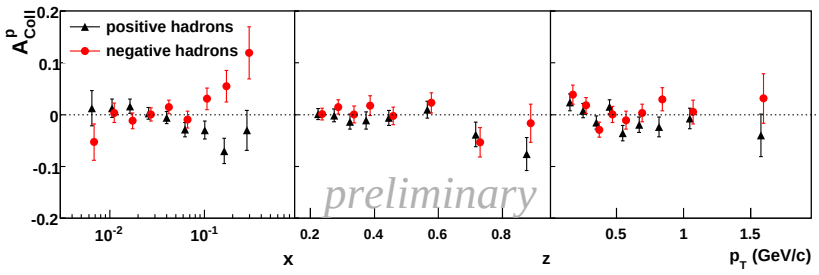

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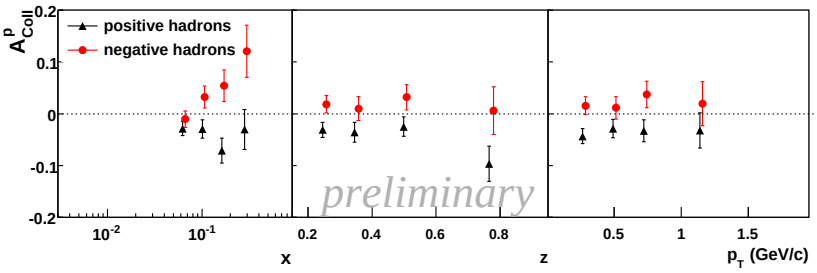

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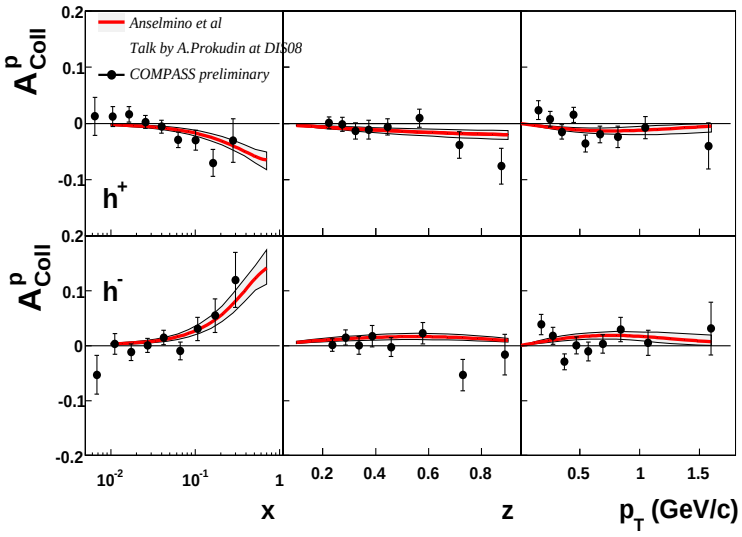

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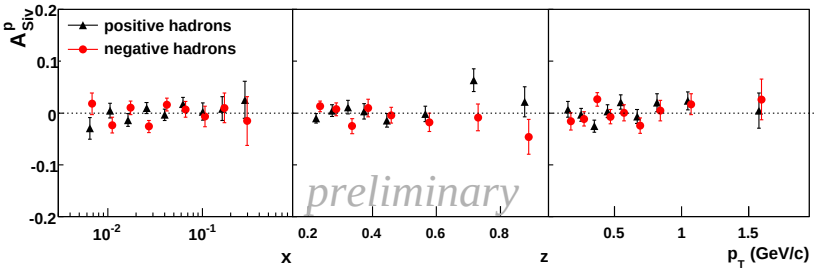

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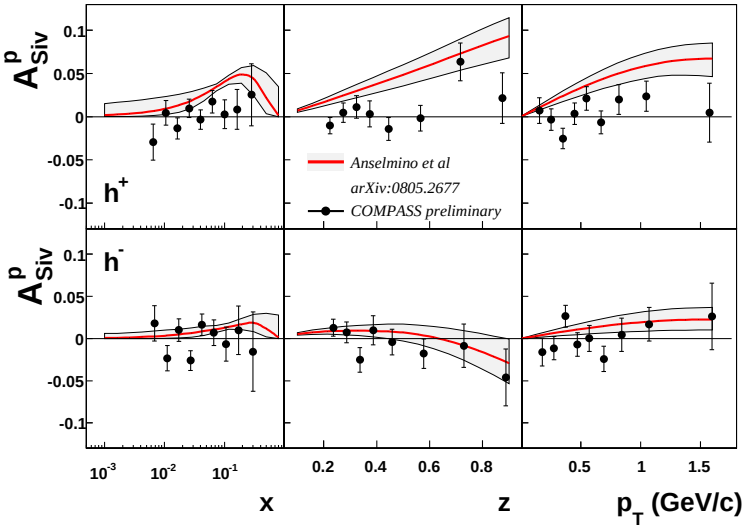

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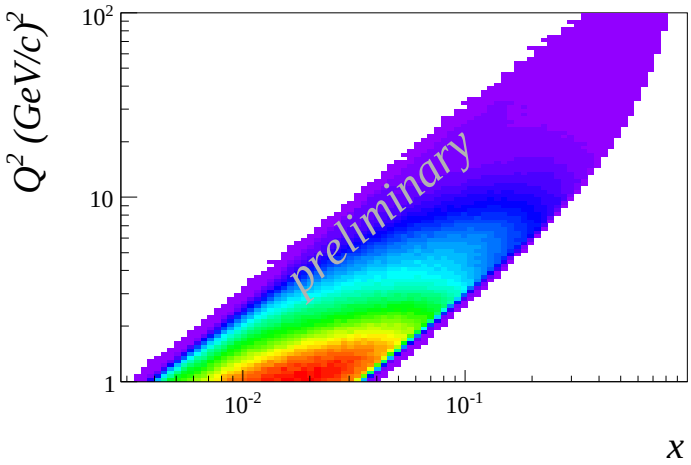

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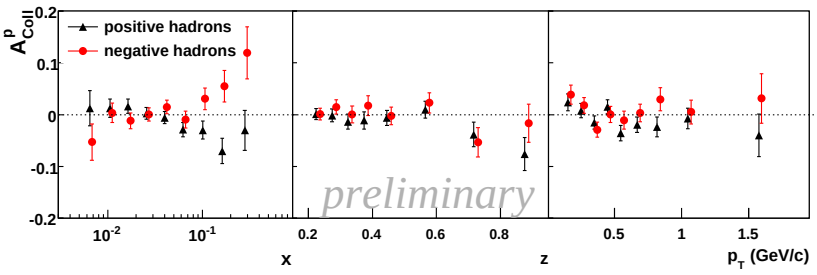

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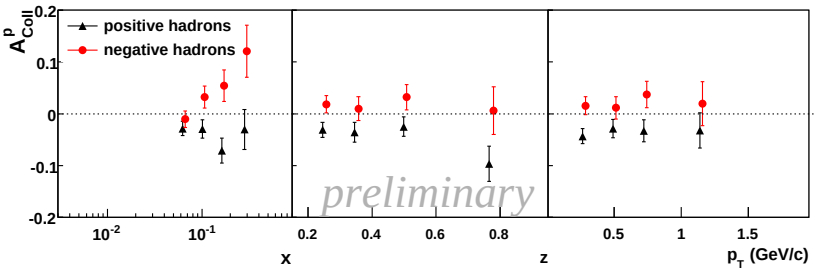

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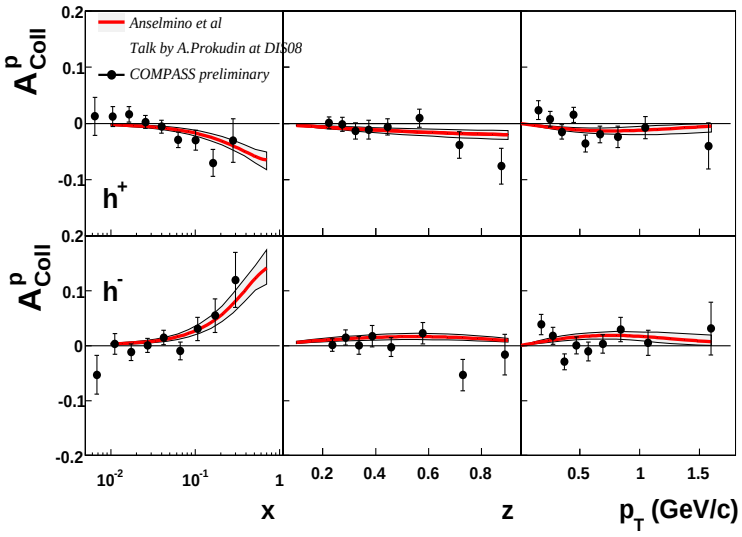

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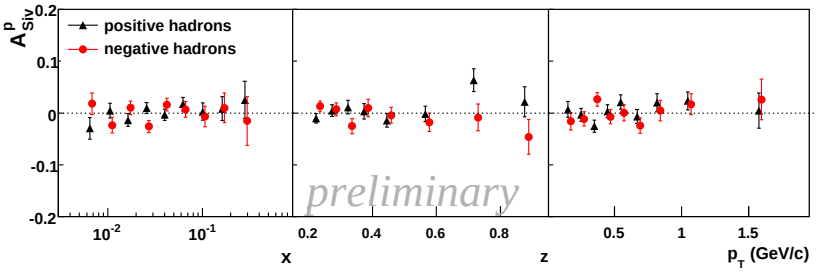

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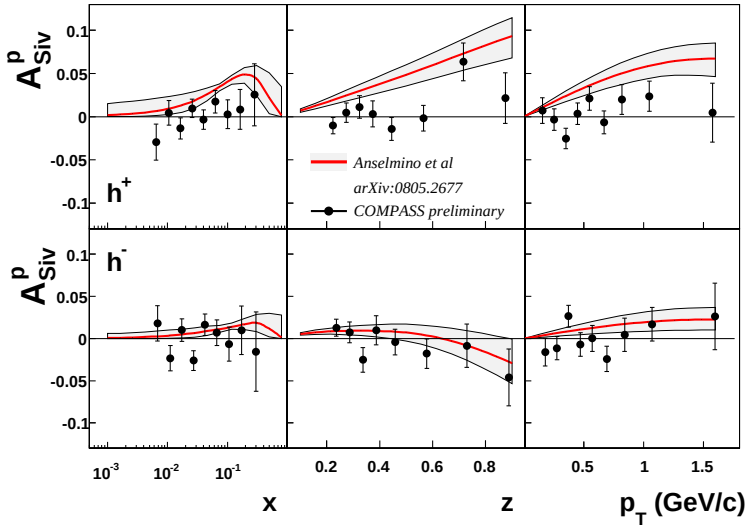

Fig. 6. COMPASS Sivers asymmetry on proton for positive and negative hadrons, with the latest prediction of Anselmino et *al.*

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